單選題（每題 4 分，答錯倒扣 1 分）

1. The coefficient of the static friction between a tennis player's hand and his racket is 0.4. How hard must he squeeze the racket if he wants to exert a force of 200N along its longitudinal axis? (a) 50N (b) 80 N (c) 500N (d) 800N.

2. You are trying to lift a 10kg dumbbell by pulling upward on it with a 120N force. What will be the dumbbell's acceleration as you lift it upward? (Let gravitational acceleration g=10m/s^2 downward) (a) 1.2 m/s^2 (b) 2m/s^2 (c) 10 m/s^2 (d) 12 m/s^2.

3. A kicked football leaves the foot of a punter with a linear velocity of 30m/s. If the leg (length = 0.5 m) is straight at the moment of contact with the ball, what is the angular velocity of the leg? (a) 15 deg/s (b) 15 rad/s (c) 60 deg/s (d) 60 rad/s.

4. A particle moves in simple harmonic motion. Knowing that its position function is x(t) = a sin ωt. What's the frequency (Hz) of the harmonic motion? (a) 1/ω (b) ω (c) $\omega/2\pi$. (d) $2\pi\omega$.

5. Similar to the above, the maximum acceleration of this particle is (a) a^2 (b) ω^2 (c) aω^2 (d) a$^2\omega$.

6. Two identical cars collide head on. Each car is traveling at 100 km/h. The impact force on each car is the same as hitting a solid wall (which does not move at all) at: (a) 100 km/h　(b) 200 km/h　(c) 150 km/h　(d) 50 km/h.

7. John is standing in a train which is traveling at 60km/h to the east. He then decides to do some exercise by jumping straight upward. When he lands, his position should be: (a) A little bit east to the original position. (b) A little bit west to the original position. (c) At the same position. (d) None of the above.

8. A long jumper takes off with his center of mass (COM) height = 1m and lands with COM height = 0.5m. To maximize jumping distance, the takeoff angle (the angle between the takeoff velocity vector and the horizontal line) should be: (a) 45deg　(b) >45deg　(c) <45deg　(d) Regardless of the takeoff angle.

9. A diver is performing backward somersaults in the air. If she wants to slow down her rotational angular velocity, she should: (a) Extend her body more (b) Flex her body segments more　(c) Keep the same posture　(d) None of the above.

10. Suppose a human body is modeled with the arms (8kg), trunk (30kg), and lower bodies (25kg), connected by hinge joints. The vertical acceleration of the trunk and lower bodies is 4 m/s^2 and 3 m/s^2, respectively (both upward). The ground vertical reaction force (acting on the lower bodies only) is 800N upward. What is the force magnitude exerted on the arms from the trunk segment? (Let g=10m/s^2 downward) (a) 85N　(b) 75N　(c) 65N　(d) 55N.

(背面仍有題目，請繼續作答)

計算題（每題 10 分，可用中文回答）

1. The formula below can be used to determine the average acceleration to which a body is exposed on a vibration platform. The result is a metric measure relative to earth's gravity (g-force):

$$a = \frac{d(2\pi f)^2}{g\sqrt{2}}$$

where, d = amplitude (m), f = frequency (Hz) of the vibration, and g =10 m/s^2, π = 3.14, $\sqrt{2}$ =1.414. Please calculate the average accelerations of the following vibrating platforms with:

(1) Frequency =10Hz, amplitude = 6 mm.

(2) Frequency = 30Hz, amplitude = 2 mm.

2. A 60kg man skies down along a curved slope. If his instant speed is 10 m/s (in tangential direction) at point A, and the radius of curvature ρ is 10 m. What's the ground reaction force exerting on him at the point A ? (if g = 10 m/s^2)

ρ=10 m

A
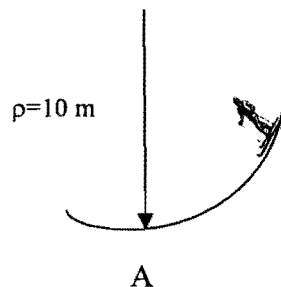
3. A baseball bat is positioned horizontally and suspended by two force gauges at the endpoints as shown in the figure below. The reading is w_1 and w_2 for the left gauge and the right gauge, respectively.

(1) What is the distance between the center of mass of this bat to point O, the endpoint of its grip?

(2) The moment of inertia I_o about an axis through point O can be determined by using a pendulum approach. What's the moment of inertia for an axis through the center of mass of the bat? Please express your answer in terms of I_o.

W_1 ⊗ W_2

L

O
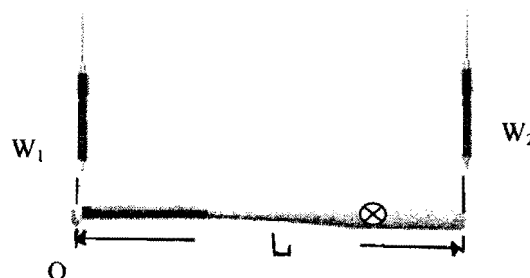
4. A group of people are dropped at the same time from an airplane at the height of 100m above the Pacific Ocean. From pure physics laws they should touch the water surface at the same time. Please list any reasons you can think of for them to touch the water surface at different timings.

5. Karen is playing with 3-year old Allison by placing her in the seat of the children's swing. Karen pulls the long chain (length = L) back to make an angle θ with the vertical and lets Allison (mass = M) go. Assuming negligible friction, chain mass and air resistance, determine Allison's speed at the lowest point in the trajectory. Express your answer in terms of L, θ, M, and g (gravitational acceleration).
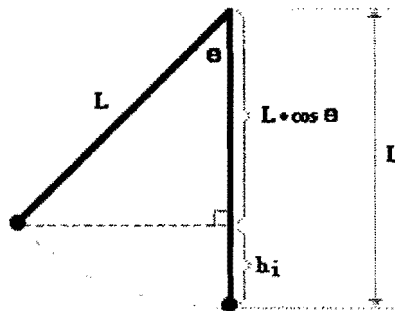
6. A hunter is aiming at a monkey (which is in front of him L meters horizontally) with his gun. List the horizontal and vertical position of the bullet at time = T after he fires. Also show that if the money falls down at the same instant as the hunter pulls the trigger, it will still be shot regardless of the L value (before ground contact).